GEI Consultants, Inc.

1021 Main Street
Winchester, MA 01890-1943
617•721•4000

May 19, 1993
Project 92294

Chief, Geotechnical Engineering Division
U.S. Army Corps of Engineers, New England Division
424 Trapelo Road
Waltham, MA 02254

Dear Sir:

Re: **Report on Well Cleaning Activities**
**Hopkinton Lake Dam**
**Hopkinton, New Hampshire**
**Contract DACW-33-91-D-008, Delivery Order 7**

This letter report describes the work performed in November 1992 regarding cleaning of relief wells at Hopkinton Lake Dam. GEI Consultants, Inc. (GEI) engaged Alford Roger Cullimore Concepts Inc. (ARCC) of Daytona Beach, Florida, to clean and redevelop the wells using the "Blended Chemical Heat Treatment" process. During initial bailing of the wells and removal of sediment, it appeared that the sediment in the wells was contaminated with creosote or other compounds. Because of concerns regarding potential contamination of the Contoocook River and disposal of contaminated sediment, the Corps of Engineers decided to suspend work.

**Summary of Work**

Thursday, October 29, 1992 - ARCC arrived at the site with rig.

Week of Monday, November 2, 1992 - ARCC prepared rig and equipment. Chemicals were delivered and unloaded.

Thursday, November 5, 1992 - Site meeting with GEI, ARCC, and Corps of Engineers personnel to discuss details of work and schedule.

Monday, November 9, Through Thursday, November 12, 1992 - ARCC and GEI began bailing wells using a pump to remove sediment. Observed possible creosote contamination. Obtained samples of sediment using a bailer for delivery to Corps and for chemical testing by Corps environmental laboratory.

Friday, November 13, 1992 - ARCC reloaded chemicals for return to supplier and demobilized rig.

Wednesday, March 3, 1993 - GEI received Corps letter directing termination of Delivery Order No. 7 of Contract No. DACW-33-91-D-008.

**Sediment Sampling**

The well locations are shown on the attached sketch (Fig. 1) provided by the Corps. The design drawings for the wells (Fig. 2) indicate that the relief wells are 74 feet deep. The GEI measured depth to the top of sediment and estimated sediment thickness in each well was as follows. The Corps measurements from August 1992 are shown for comparison. Figures 3 and 4 show the Corps data of sediment thickness over time.

| Well | Depth from Top of Casing to Top of Sediment Measured by GEI November 11, 1992 (feet) | Estimated Sediment Thickness (feet) | Sediment Thickness Reported by Corps in August 1992 (feet) |
|---|---|---|---|
| RW-1 | 71.0 | 3.0 | 2.7 |
| RW-2 | 62.4 | 11.6 | 10.8 |
| RW-3 | 67.5 | 6.5 | 6.5 |
| RW-4 | 63.7 | 10.3 | 10.4 |
| RW-5 | 64.9 | 9.1 | 8.4 |
| RW-6 | 61.9 | 12.1 | 11.5 |
| RW-7 | 66.1 | 7.9 | 6.3 |
| RW-8 | 67.5 | 6.5 | 9.0 |

Each of the eight wells was bailed with a 4-inch-diameter bailer to recover some of the sediment at the base of the wells. Material recovered consisted of black sludge/organic silt-like material with minor quantities of silt and fine to medium sand. The material

exhibited an oily sheen and had a strong smell similar to that of creosote. Additional samples recovered at RW-4 to a depth of about 70 feet indicated a similar composition at depth with the material perhaps being slightly denser and containing an increased quantity of fine to medium sand. No stratification was noted, but agitation of the sediment by the action of the bailer may have disturbed any stratification.

The liquid above the sediment was a black slurry, also with an oily sheen. Samples of the slurry and sediment from RW-4 and RW-6 were obtained for chemical analysis at the Corps environmental laboratory in Hubbardston, Massachusetts.

**Results of Chemical Analyses**

The results of chemical analyses performed by the Corps are presented in Appendix A. The Corps report concludes that the sediment obtained from the wells was contaminated with coal/oil tar creosote.

Sincerely yours,

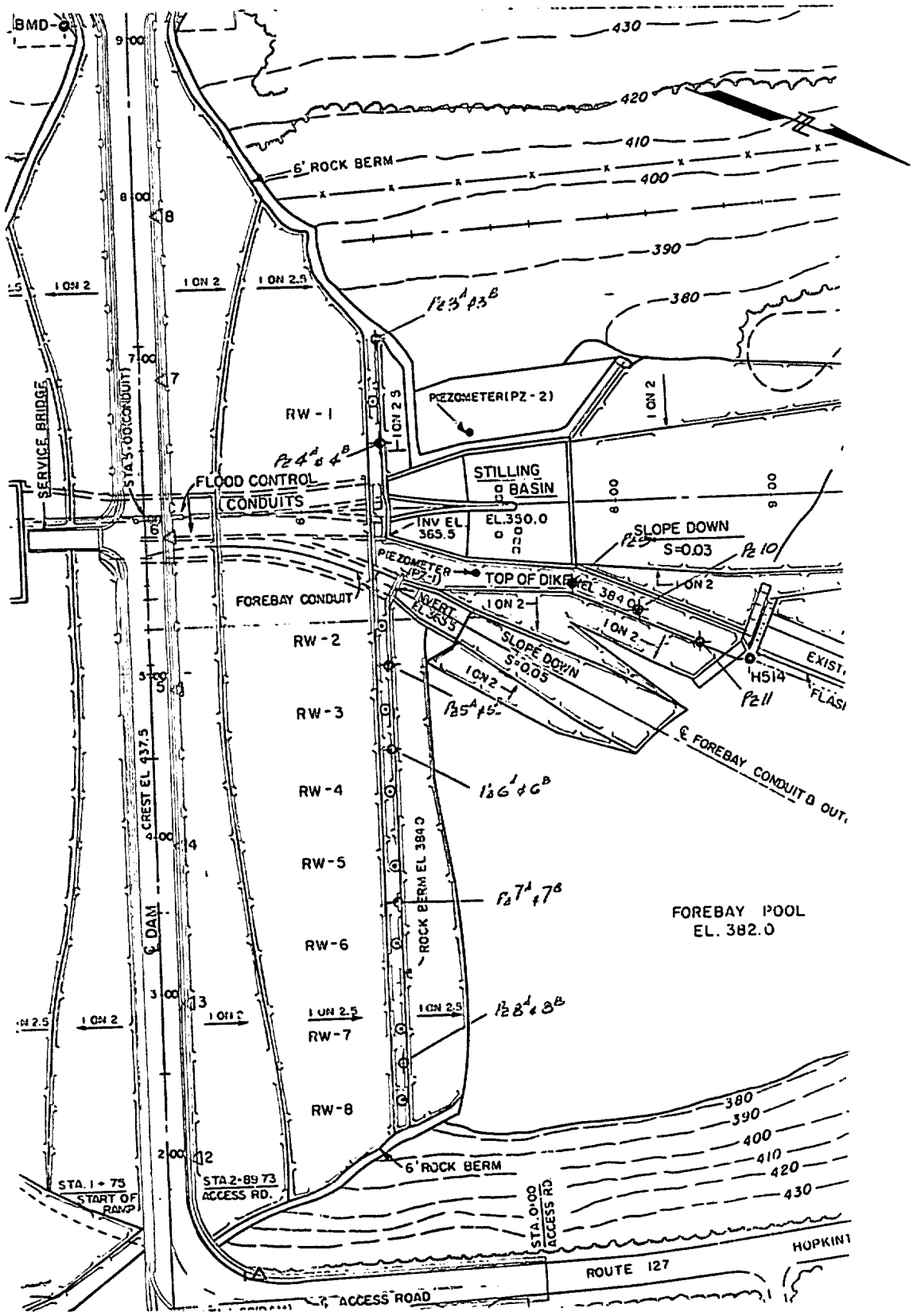
GEI CONSULTANTS, INC.

Michael Paster

Michael Paster, P.E.
Project Manager

MP:ms

Attachments




NOT TO SCALE

| | | |
|---|---|---|
| U.S. Army Corps of Engineers<br>New England Division<br>Waltham, Massachusetts | Hopkinton Lake Dam<br>Hopkinton, New Hampshire | RELIEF WELL LOCATIONS |
| GEI Consultants, Inc. | Project 92294 | March 1993 Fig. 1 |

3/17/93 DTC 10048226

CORPS OF ENGINEERS

U. S. ARMY

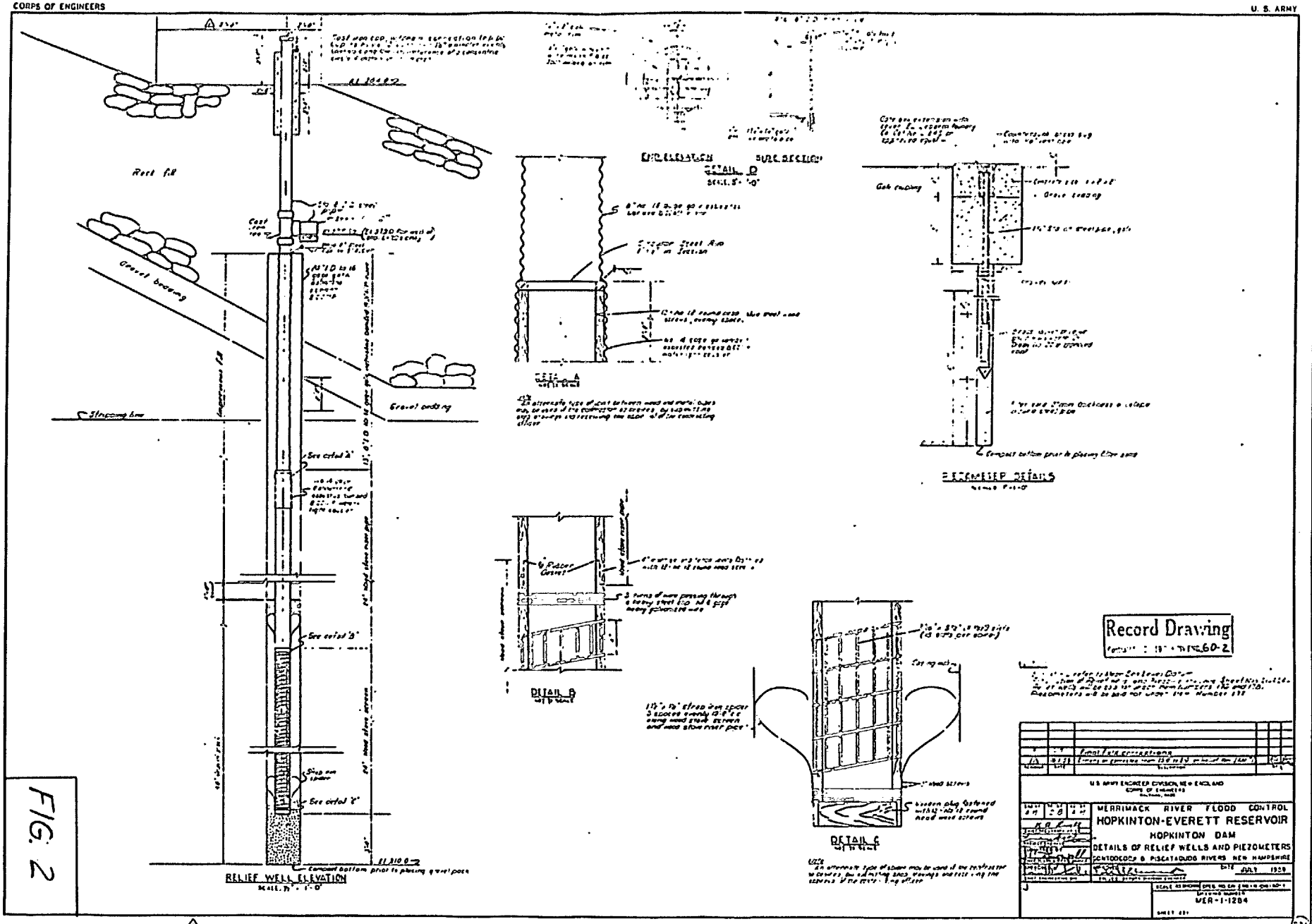
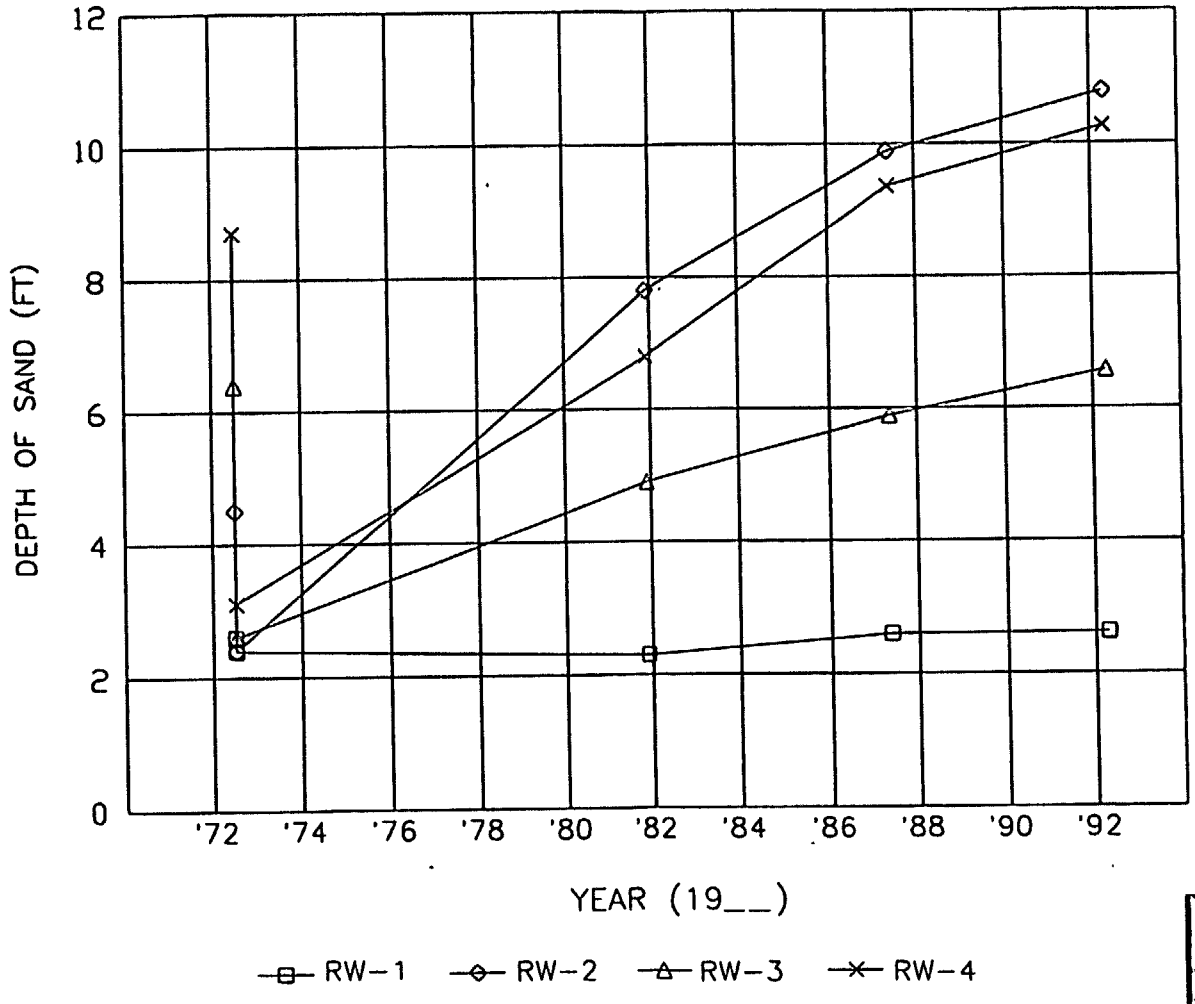



FIG. 2

# ACCUMULATION OF SEDIMENT IN RELIEF WELLS 1-4



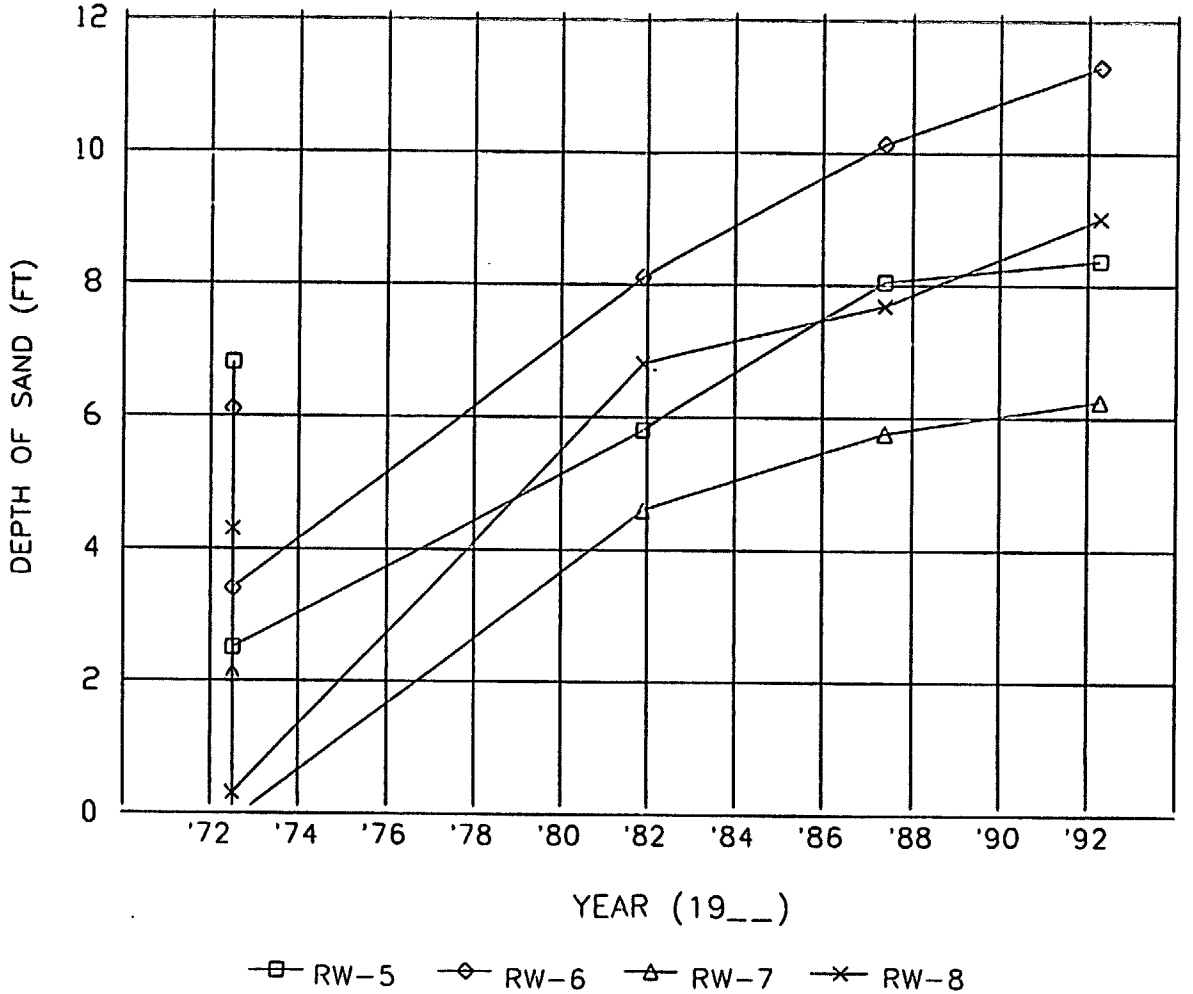

NOTE: The wells were flushed and cleaned in the summer of 1972

FIG. 3

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

| | |
|---|---|
| LCD DESIGN BY | MERRIMACK VALLEY FLOOD CONTROL |
| MAV CHECK BY | HOPKINTON DAM |
| LCD DRAWN BY | ACCUMULATION OF SEDIMENT IN RELIEF WELLS 1-4 |
| GEOTECH. ENG. DIV. PLATE NO. 67 | SCALE: AS SHOWN DATE: AUGUST 1992 |

# ACCUMULATION OF SEDIMENT IN RELIEF WELLS 5-8




NOTE: The wells were flushed and cleaned in the summer of 1972

FIG. 4

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

| | |
|---|---|
| LCD DESIGN BY | MERRIMACK VALLEY FLOOD CONTROL |
| MAV CHECK BY | HOPKINTON DAM |
| LCD | ACCUMULATION OF SEDIMENT IN RELIEF WELLS 5-8 |
| GEOTECH. ENG. DIV. PLATE NO. 68 | SCALE: AS SHOWN<br>DATE: AUGUST 1992 |

# APPENDIX A

Analytical Data Report
Hopkinton Wells

by

U.S. Army Corps of Engineers
New England Division
Environmental Laboratory
Hubbardston, MA 01452

March 26, 1993


Hubbardston MA 01452

# Analytical Data Report

## HOPKINTON WELLS

U.S. Army Corps of Engineers
New England Division
Environmental Laboratory
Hubbardston, MA 01452

Date: March 26, 1993

Brian J. Condike
Chief, Environmental Laboratory

TABLE OF CONTENTS

# 1. Case Summary

HOPKINTON WELLS (11/13/92)

1. Two sediment samples were received for the above subject project on 13 November 1992. The correct sample containers and sample preservation procedures were followed unless otherwise indicated on the cooler receipt form. Copies of the chain-of-custody records are enclosed for reference, along with a list of the samples collected.

2. The following analyses were performed in-house:

| Analysis | EPA Method |
|---|---|
| **Sediment samples:** | |
| Fuel Identification | * |
| Total Petroleum Hydrocarbons | 9071/418.1 |
| Arsenic | 3051/7060 |
| Lead | 3051/6010 |
| Volatile Organics | 8240 |
| Polynuclear Aromatic Hydrocarbons | 3540/8270 |

* - Proposed Practive Oil Spill Source Identification by Combined Gas Chromatography and Positive Ion Electron Impact Low Resolution Mass Spectrometry, ASTM, Draft 1, Jan., 1991.

Contaminated Soils - Diesel Fuel Contamination, written by Paul T. Kostecki and Edward Calabrese, Chapter 1 - The Use of Hydrocarbon Analyses for Environmental Assessment and Remediation.

# 2. Sample Listing

U.S. ARMY CORPS OF ENGINEERS - ENVIRONMENTAL LABORATORY

SAMPLE LISTING

January 23, 1993

| LAB. NO. | SAMPLE IDENTIFICATION | SAMPLE DATE | MATRIX |
|---|---|---|---|
| A-19445 | RW-4 | 11/11/92 | SEDIMENT |
| A-19446 | RW-6 | 11/12/92 | SEDIMENT |

# 3. Laboratory Data

# FUEL IDENTIFICATION*- SAMPLE NUMBER 19445 AND 19446

Samples 19445 and 19446 demonstrate a predominance of polynuclear aromatic hydrocarbons (PAH) and in particular the pyrogenic polynuclears fluoranthene, phenanthrene, and pyrene. The relative concentrations of the polynuclear aromatics for these environmental numbers are plotted in the accompanying figure along with the distributions for a coal-tar creosote, (all relative to chrysene). Aside from naphthalene, (which concentration could have easily been significantly reduced over years of water contact due to solubilization), the predominance of the pyrogenic PAHs for both samples and the creosote standard is evident.

Although coal tar/oil creosote does, in fact, have significant amounts of phenolic compounds, (about 10% by weight relative to 85% PAH content), since these acidic organics are extremely soluble in water, (5 to 6 orders of magnitude greater than the solubility of the PAHs), leaching over time could very easily, in the space of decades, reduce the phenolic concentrations drastically. (In fact only xylenol, one of the least soluble phenolics present in creosote was actually encountered near the detection limit).

Conclusion:

Samples 19445 and 19446 consist of coal oil/tar creosote. Creosote is commonly used to preserve wood to protect it from rot and worms. (Due to the relatively higher concentration of pyrogenic PAH's and lower concentrations of naphthalenes, these creosote samples are probably from a coal tar source). The fact that the phenolics are virtually absent can be accounted for by their solubilization/leaching over decades of years while the creosote was in water contact. Pentachlorophenol was not detected. Due to its relatively poor water solubility, it seems unlikely this chemical was added to the creosote for its wood preserving characteristics.

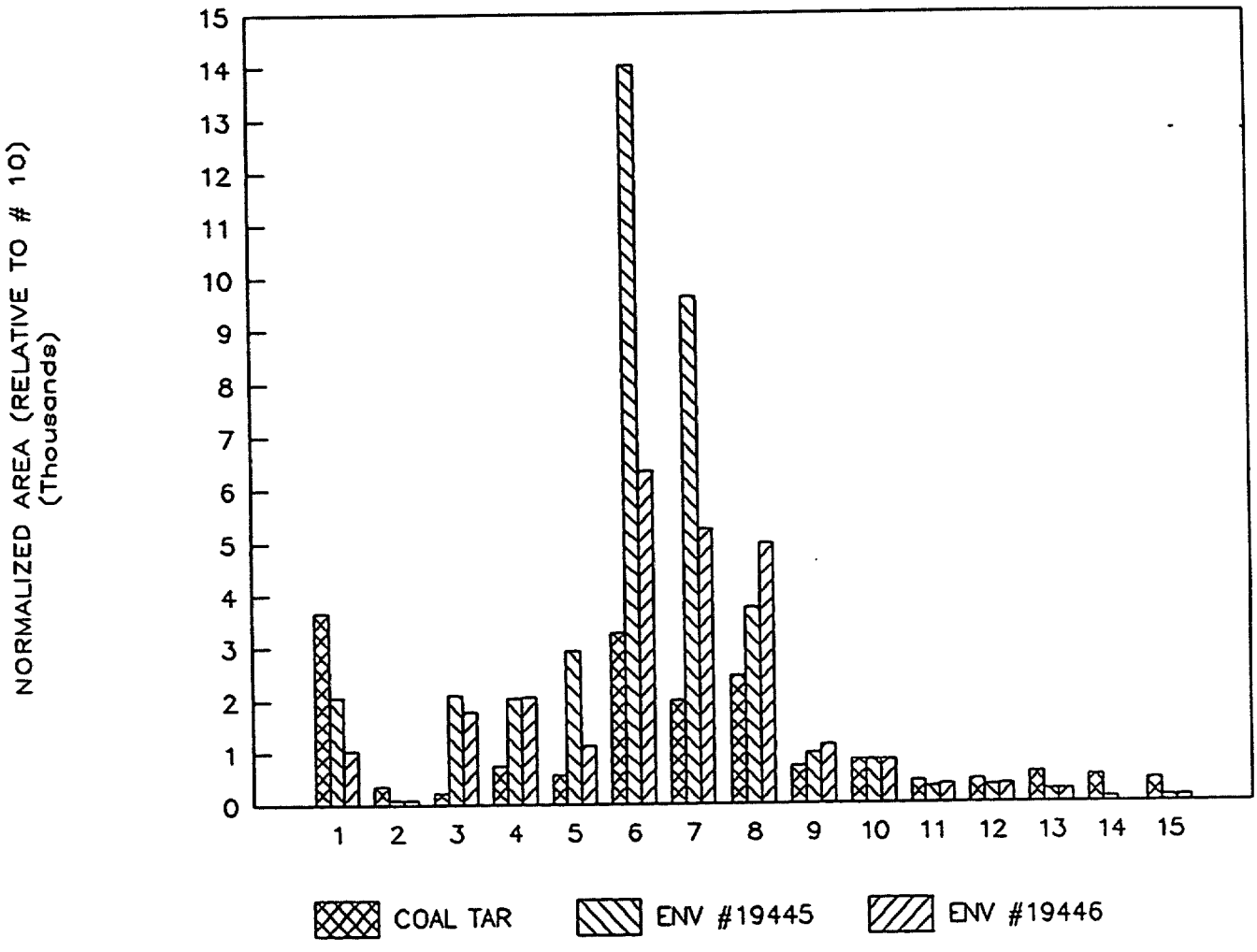
*Method References:

Proposed Practice Oil Spill Source Identification by Combined Gas Chromatography and Positive Ion Electron Impact Low Resolution Mass Spectrometry, ASTM, Draft 1, Jan, 1991.

Contaminated Soils - Diesel Fuel Contamination, written by Paul T. Kostecki and Edward Calabrese, Chapter 1 - The Use of Hydrocarbon Analyses for Environmental Assessment and Remediation.

# RELATIVE CONCENTRATIONS OF PREDOMINANT

## POLYNUCLEAR AROMATIC HYDROCARBONS




1 Naphthalene
2 Acenaphthylene
3 Acenaphthene
4 Fluorene
5 Anthracene
6 Phenanthrene
7 Fluoranthene
8 Pyrene
9 Benzo(a)anthracene
10 Chrysene
11 Benzo(b)fluoranthene
12 Benzo(k)fluoranthene
13 Benzo(a)pyrene
14 Indeno(1,2,3-c,d)pyrene
15 Benzo(g,h,i)perylene

U.S. ARMY CORPS OF ENGINEERS - ENVIRONMENTAL LABORATORY

January 23, 1993

| Lab# | Field Description | Test | Result | Units | Date Analyzed |
|---|---|---|---|---|---|
| A-19445 | RW-4 | Total Petroleum Hydrocarbons | 1400 | ppm | 12/14/92 |
| A-19446 | RW-6 | Total Petroleum Hydrocarbons | 180 | ppm | 12/14/92 |

Reviewed By: Katherine Miller, Analyst

Approved By: _____, Chief Chemist

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION, ENVIRONMENTAL LABORATORY

PRODUCED ON 01/23/93
14:19

HOPKINGTON WELLS (11/13/92)

METHOD 9071/418.1: TOTAL PETROLEUM HYDROCARBONS (ppm) - SEDIMENT

| ENV NO. | TOTAL PETROLEUM HYDROCARBONS | DATE EXTRACTED | DATE ANALYZED |
|---|---|---|---|
| METHOD BLANK | < 4.8 | 12/4/92 | 12/14/92 |

U.S. ARMY CORPS OF ENGINEERS - ENVIRONMENTAL LABORATORY

- TRACE METALS RESULTS

January 23, 1993

| Lab# | Field Description | Test | Result | Units | Date Digested | Date Analyzed |
|---|---|---|---|---|---|---|
| A-19445 | RW-4 | Arsenic | 28 | ug/g | 12/16/92 | 12/28/92 |
| | | Lead | 130 | ug/g | 12/16/92 | 12/28/92 |

Reviewed By: Paul V. West, Analyst

Approved By: _____, Chief Chemist

U.S. ARMY CORPS OF ENGINEERS - ENVIRONMENTAL LABORATORY

- TRACE METALS RESULTS

January 23, 1993

| Lab# | Field Description | Test | Result | Units | Date Digested | Date Analyzed |
|---|---|---|---|---|---|---|
| A-19446 | RW-6 | Arsenic | 11 | ug/g | 12/16/92 | 12/28/92 |
| | | Lead | 70 | ug/g | 12/16/92 | 12/28/92 |

Reviewed By: Paul V. Johnston, Analyst

Approved By: _____, Chief Chemist

U.S. ARMY CORPS OF ENGINEERS - ENVIRONMENTAL LABORATORY

- TRACE METALS RESULTS

January 23, 1993

| Lab# | Field Description | Test | Result | Units | Date Digested | Date Analyzed |
|---|---|---|---|---|---|---|
| A-19446 | RW-6 | Arsenic | 11 | ug/g | 12/16/92 | 12/28/92 |
| | | Lead | 70 | ug/g | 12/16/92 | 12/28/92 |

Reviewed By: Paul V. Jones, Analyst

Approved By: _____, Chief Chemist

U. S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION, ENVIRONMENTAL LABORATORY

PRODUCED ON 01/23/93
14:30

HOPKINTON WELLS (11/13/92)

TRACE METAL RESULTS - SEDIMENT (ppm)

| PARAMETER | METHOD BLANK |
|---|---|
| rsenic | < 0.20 |
| ead | < 0.60 |

SAMPLE DATE:
DATE DIGESTED: 12/16/92
DATE ANALYZED: 12/28/92 - 1/5/93

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION, ENVIRONMENTAL LABORATORY

PRODUCED ON 02/02/93
07:53

## HOPKINGTON WELLS (11/12/92)

## METHOD 8240: VOLATILE ORGANICS - SEDIMENT (ug/kg)

| PARAMETER | | 19445 RW-4 SEDIMENT | | 19446 RW-6 SEDIMENT | | METHOD BLANK SEDIMENT |
|---|---|---|---|---|---|---|
| Chloromethane | < | 25 | < | 25 | < | 5.0 |
| Vinyl chloride | < | 25 | < | 25 | < | 5.0 |
| Bromomethane | < | 25 | < | 25 | < | 5.0 |
| Chloroethane | < | 25 | < | 25 | < | 5.0 |
| 1,1-Dichloroethene | < | 10 | < | 10 | < | 2.0 |
| Acetone | < | 150 | < | 150 | < | 30 |
| Carbon disulfide | < | 10 | < | 10 | < | 2.0 |
| Methylene chloride | B | 46 | B | 128 | | 5.1 |
| trans-1,2-Dichloroethene | < | 10 | < | 10 | < | 2.0 |
| 1,1-Dichloroethane | < | 10 | < | 10 | < | 2.0 |
| cis-1,2-Dichloroethene | < | 10 | < | 10 | < | 2.0 |
| 2-Butanone | < | 150 | < | 150 | < | 30 |
| Chloroform | < | 10 | < | 10 | < | 2.0 |
| 1,1,1-Trichloroethane | < | 10 | < | 10 | < | 2.0 |
| Carbon tetrachloride | < | 10 | < | 10 | < | 2.0 |
| Benzene | < | 10 | < | 10 | < | 2.0 |
| 1,2-Dichloroethane | < | 10 | < | 10 | < | 2.0 |
| Trichloroethene | < | 10 | < | 10 | < | 2.0 |
| 1,2-Dichloropropane | < | 10 | < | 10 | < | 2.0 |
| Bromodichloromethane | < | 10 | < | 10 | < | 2.0 |
| 4-Methyl-2-pentanone | < | 100 | < | 100 | < | 20 |
| cis-1,3-Dichloropropene | < | 10 | < | 10 | < | 2.0 |
| Toluene | < | 10 | < | 10 | < | 2.0 |

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION, ENVIRONMENTAL LABORATORY

PRODUCED ON 02/02/93
07:53

## HOPKINGTON WELLS (11/12/92)

## METHOD 8240: VOLATILE ORGANICS - SEDIMENT (ug/kg)

| PARAMETER | | 19445 RW-4 SEDIMENT | | 19446 RW-6 SEDIMENT | | METHOD BLANK SEDIMENT |
|---|---|---|---|---|---|---|
| trans-1,3-Dichloropropene | < | 10 | < | 10 | < | 2.0 |
| 1,1,2-Trichloroethane | < | 10 | < | 10 | < | 2.0 |
| Tetrachloroethene | < | 10 | < | 10 | < | 2.0 |
| 2-Hexanone | < | 100 | < | 100 | < | 20 |
| Dibromochloromethane | < | 10 | < | 10 | < | 2.0 |
| Chlorobenzene | < | 10 | < | 10 | < | 2.0 |
| Ethylbenzene | < | 10 | < | 10 | < | 2.0 |
| m/p Xylene | J | 10 | < | 10 | < | 2.0 |
| O-Xylene | < | 10 | < | 10 | < | 2.0 |
| Styrene | < | 10 | < | 10 | < | 2.0 |
| Bromoform | < | 10 | < | 10 | < | 2.0 |
| 1,1,2,2-Tetrachloroethane | < | 10 | < | 10 | < | 2.0 |
| Surrogate Recovery (%) | | | | | | |
| 1,2-Dichloroethane D4 (70-121) | | 116 | | 114 | | 90 |
| Toluene D8 (84-138) | | 100 | | 98 | | 101 |
| 4-Bromofluorobenzene (59-113) | | 86 | | 92 | | 78 |
| DILUTION FACTOR | | 5.0 | | 5.0 | | 1.0 |
| SAMPLE DATE: | | 11/11/92 | | 11/12/92 | | |
| DATE ANALYZED: | | 11/19/92 | | 11/19/92 | | 11/19/92 |

B - Analyte also detected in the method blank.
J - Estimated value; analyte detected at < the Practical Quantitation Limit.
* - Highly degraded petroleum oil present.

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION, ENVIRONMENTAL LABORATORY

PRODUCED ON 03/16/93
14:50

# HOPKINTON WELLS (11/12/92)

## EPA METHOD : POLYNUCLEAR AROMATIC HYDROCARBONS (ug/g)

| ANALYTE | | 19445 RW-4 SEDIMENT | | 19446 RW-6 SEDIMENT | METHOD BLANK SEDIMENT |
|---|---|---|---|---|---|
| Napthalene | | 118 | | 22 | < 0.0043 |
| 2-Methyl napthalene | | 71 | | 14 | < 0.0043 |
| Acenaphthylene | | 5.0 | | 1.8 | < 0.0043 |
| Acenaphthene | | 121 | | 38 | < 0.0043 |
| Fluorene | | 117 | | 44 | < 0.0043 |
| Phenanthrene | U | 795 | | 135 | < 0.0043 |
| Anthracene | | 167 | | 25 | < 0.0043 |
| Fluoranthene | | 545 | | 111 | < 0.0043 |
| Pyrene | | 212 | | 105 | < 0.0043 |
| Benzo(a)anthracene | | 56 | | 24 | < 0.0043 |
| Chrysene | | 48 | | 18 | < 0.0043 |
| Benzo(b)fluoranthene | | 19 | | 8.4 | < 0.0043 |
| Benzo(k)fluoranthene | | 20 | | 8.9 | < 0.0043 |
| Benzo(a)pyrene | | 16 | | 5.7 | < 0.0043 |
| Dibenzo(a,h)anthracene | J | 1.5 | < | 0.081 | < 0.0043 |
| Benzo(g,h,i)perylene | | 6.4 | | 2.5 | < 0.0043 |
| Indeno(1,2,3-cd)pyrene | | 5.2 | < | 0.081 | < 0.0043 |
| DILUTION FACTOR | | 1.1 | | 0.81 | 0.043 |
| Surrogate Recoveries (%) | | | | | |
| 2-Fluorobiphenyl (30-115) | | 92 | | 91 | 89 |
| Nitrobenzene-D5 (23-120) | | 98 | | 95 | 91 |
| Terphenyl-D14 (18-137) | | 163 | | 148 | 74 |

| | | | |
|---|---|---|---|
| SAMPLE DATE: | 11/11/92 | 11/12/92 | |
| DATE RECEIVED: | 11/12/92 | 11/12/92 | |
| DATE EXTRACTED: | 11/24/92 | 11/24/92 | 11/24/92 |
| DATE ANALYZED: | 11/26/92 | 11/26/92 | 11/25/92 |

J - Estimate value; greater than Detection Limit, but less than Practical Quantitation Limit.
U - Above the upper calibration limit.

# 4. Quality Assurance Data

## TOTAL PETROLEUM HYDROCARBONS
## BLANK SPIKE/BLANK SPIKE DUPLICATE
## PRECISION

| COMPOUND / DATE ANALYZED: 12/14/92 | BLANK SPIKE RECOVERY (%) | BLANK SPIKE DUPLICATE RECOVERY (%) | RELATIVE PERCENT DEVIATION (RPD) | RPD MAXIMUM | IN OR OUT OF QC LIMITS |
|---|---|---|---|---|---|
| *Total Petroleum Hydrocarbons | 55 | 65 | 17 | 66 | IN |

## ACCURACY

| COMPOUND | BLANK SPIKE RESULT | BLANK RESULT | SPIKE ADDED | SPIKE RECOVERY % | CONTROL LIMITS REC | IN OR OUT OF QC LIMITS |
|---|---|---|---|---|---|---|
| *Total Petroleum Hydrocarbons | 22 | < 4.8 | 40 | 55 | 50 - 150 | IN |

## TRACE METAL ANALYSIS
## BLANK SPIKE/BLANK SPIKE DUPLICATE
## SEDIMENT
## PRECISION

| PARAMETER<br>12/16/92 | BLANK SPIKE RECOVERY (%) | BLANK SPIKE DUPLICATE RECOVERY (%) | RELATIVE PERCENT DEVIATION (RPD) | MAXIMUM ACCEPTABLE RPD | IN OR OUT OF QC LIMITS |
|---|---|---|---|---|---|
| Arsenic | 94 | 91 | 3 | 30 | IN |
| Lead | 101 | 106 | 4 | 30 | IN |

## TRACE METAL ANALYSIS
## BLANK SPIKE/BLANK SPIKE DUPLICATE
## SEDIMENT
## ACCURACY

| PARAMETER<br>12/16/92 | BLANK SPIKE RESULT | BLANK RESULT | SPIKE ADDED | SPIKE RECOVERY % | CONTROL LIMITS REC | IN OR OUT OF QC LIMITS |
|---|---|---|---|---|---|---|
| Arsenic | 4.7 | < 0.20 | 5.0 | 94 | 75 - 125 | IN |
| Lead | 5.1 | < 0.60 | 5.0 | 101 | 75 - 125 | IN |

VOLATILE ORGANIC BLANK SPIKE-BLANK SPIKE DUPLICATE
SEDIMENT
PRECISION

| COMPOUND<br>DATE ANALYZED: 11/19/92 | BLANK SPIKE RECOVERY | BLANK SPIKE DUPLICATE RECOVERY | RELATIVE PERCENT DEVIATION (RPD) | MAXIMUM ACCEPTABLE RPD | IN OR OUT OF QC LIMITS |
|---|---|---|---|---|---|
| 1,1-Dichloroethene | 71 | 66 | 7 | 22 | IN |
| Benzene | 80 | 81 | 1 | 21 | IN |
| Trichloroethene | 80 | 79 | 1 | 24 | IN |
| Toluene | 71 | 75 | 5 | 21 | IN |
| Chlorobenzene | 74 | 79 | 7 | 21 | IN |

SOIL
ACCURACY

| SPIKING COMPOUND | MATRIX SPIKE RECOVERY | ACCEPTABLE RANGE | IN OR OUT OF QC LIMITS |
|---|---|---|---|
| 1,1-Dichloroethene | 71 | 59 - 172 | IN |
| Benzene | 80 | 66 - 142 | IN |
| Trichloroethene | 80 | 62 - 137 | IN |
| Toluene | 71 | 59 - 139 | IN |
| Chlorobenzene | 74 | 60 - 133 | IN |

POLYNUCLEAR ARMOMATIC HYDROCARBONS BLANK SPIKE-BLANK SPIKE DUPLICATE

SEDIMENT
PRECISION

| COMPOUND<br>DATE EXTRACTED: 11/24/92 | BLANK SPIKE RECOVERY | BLANK SPIKE DUPLICATE RECOVERY | RELATIVE PERCENT DEVIATION (RPD) | MAXIMUM ACCEPTABLE RPD | IN OR OUT OF QC LIMITS |
|---|---|---|---|---|---|
| Acenaphthene | 97 | 99 | 2 | 19 | IN |
| Pyrene | 63 | 64 | 2 | 36 | IN |

ACCURACY

| SPIKING COMPOUND | BLANK SPIKE RECOVERY | ACCEPTABLE RANGE | IN OR OUT OF QC LIMITS |
|---|---|---|---|
| Acenaphthene | 97 | 31 - 137 | IN |
| Pyrene | 63 | 35 - 142 | IN |

# 5. Chain of Custody

GEI Consultants, Inc. 53 Regional Drive Concord, NH 03301-8500

CHAIN OF CUSTODY RECORD

DOCUMENT NUMBER

PROJECT NAME AND NUMBER: Hopkinton Dam 922914

SAMPLERS: R. Mauck

INV #

| STATION NO. | DATE | TIME (hours) | COMP | GRAB | SAMPLE NUMBER | NO. OF CONTAINERS | VOA A+B | TPH D | Fuel ID C | Extra Hold E As, Pb | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1445 RW-4 | 11/11/92 | 1130 | | ✓ | RW-4 | 5 | | | | | |
| 1446 RW-6 | 11/12/92 | 1330 | | ✓ | RW-6 | 5 | | | | | |

| RELINQUISHED BY (SIGNATURE) | DATE/TIME (hours) | RECEIVED BY (SIGNATURE) | RELINQUISHED BY (SIGNATURE) | DATE/TIME | RECEIVED BY (SIGNATURE) |
|---|---|---|---|---|---|
| Robert Mauck | 11/13/92 0920 | Joanne Mercier | | | |
| Joanne Mercier | 11/13/92 0853 | Julie Keller | RELINQUISHED BY (SIGNATURE) | DATE/TIME | RECEIVED BY (SIGNATURE) |
| Debra | 11/13/92 1035 | RECEIVED FOR LABORATORY BY (SIGNATURE) | DATE/TIME 11/13/92 1035 | REMARKS | |

## 6. Cooler Receipt Form

CENED-ED-GL-E
SAMPLE CONTAINER RECEIPT FORM

PROJECT: Hopkington Dam

Container received on 11/13/92 and opened on 11/16/92 by: _____

_____

1. Shipper (USM, UPS, DHL, FEDEX, P/C, AIR EXP, HAND-DELIVERED)
2. Container type (Cooler, box, envelope, etc.) _____
3. Were custody seals on outside of container? N/A Yes No
   How many & where: _____, seal date: _____, seal name: _____
4. Were custody papers taped to lid inside container? N/A Yes No
5. Custody papers properly filled out? (ink, signed, etc.) Yes No
6. Was project identifiable from custody papers? Yes No
7. Did you sign custody papers in appropriate place? Yes No
8. Did you attach shipper's packing form to this form? N/A Yes No
9. Packing material (peanuts, vermiculite, bubble wrap, paper, cans, other)
10. Was sufficient ice used? Temperature 3.8 °C N/A (Yes) No
11. Were all samples sealed in separate plastic bags? N/A Yes (No)
12. Did all samples arrive in good condition? (Yes) No
13. Sample labels complete? (#, date, analysis, preservation, sign.) (Yes) No
14. Did all sample labels agree with custody papers? (Yes) No
15. Were correct sample containers used for tests indicated? N/A (Yes) No
16. Were correct preservatives used? (TM pH_____, CN- pH_____) (N/A) Yes No
17. Were VOA vials bubble-free ($H_2O$) or no headspace (soil)? N/A Yes (No)
18. Was sufficient amount of sample sent in each container? (Yes) No
19. Were air volumes noted for air samples? (N/A) Yes No
20. Were initial weights noted for pre-weighed filters? (N/A) Yes No

Discrepancies: _____

# 7. Quality Assurance Review

Quality Assurance Review
Project: Hopkinton Wells
Date: March 22,1993

Soil
#Samples-2
#Parameters-6

A. Sample Handling:

The samples were collected by a contractor using the appropriate sample containers and preservation techniques. The samples were not placed in separate bags. However, no problems were noted regarding this discrepancy. The proper chain of custody procedures were followed except that no custody seals were used. The samples arrived in good condition and were determined not to have been disturbed between collection and delivery to NED.

B. Laboratory Analysis:

1. Holding Times:
The maximum holding times between sample collection and analysis were met for arsenic, lead, and VOAs. The 28 day holding time for TPH was exceeded by five days. This will not be significant. The 14 day maximum holding time between sample collection and extraction was met for semi-volatiles as well as the 40 day holding time between extraction and analysis.

2. Method Blanks:
The method blanks for TPH, arsenic, lead, and PAH were free from contamination. A trace of methylene chloride was found in the VOA blank. It is not a problem in the low concentrations we experience. The presence of this common contaminant has been greatly reduced over the past year.

3. Methodology:
Standard EPA test procedures were used for all parameters except for fuel identification where references to a proposed ASTM procedure and a procedure from "Contaminated Soils- Diesel Fuel Identification" were used. They represent the state-of- the art methodology.

4. Surrogate Recoveries:
The surrogate recoveries for the semi-volatiles were in control except for two instances where the sample recoveries for terphenyl-d14 exceeded the acceptable range because of matrix effects. However, the departures not excessive. There may be some positive bias , but it will not be enough to affect interpretation of the sample data.

5. QA/QC Data:
The blank spikes and blank spike duplicates for the metals, TPH, VOAs, and PAHs were all in control for both precision and accuracy.

6. Assessment of data:
The data appear reasonable and internally consistent.

Forrest E. Knowles,Jr.
Quality Assurance Officer
Laboratory Testing Operations